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Exchange-Coupling in Magnetic Nanoparticles to Enhance Magnetostrictive Properties

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DISCLAIMER

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Introduction

Spark erosion is a versatile and economical method for producing particles of virtually any type of material that has a nominal conductivity: particles can be prepared in sizes ranging from a few nm to tens of μm. The purpose of this feasibility study was to demonstrate the capability of making spherical particles of specific magnetic materials. We chose (Tb Dy)Fe_2 (Terfenol-D) due to its potential use as the magnetostrictive component in magneto-elastomer composites. We also chose to work with pure Ni as a model system. Improvements in the properties of magneto-elastomer composites have broad applications in the areas of sensor development, enhanced actuators and damping systems.

Spherical particles were prepared using spark erosion for both the Terfenol D and Ni systems. These materials were characterized using x-ray diffraction, magnetization, and Scanning Electron Microscopy (SEM). Shown below in Fig. 1 is an SEM of the Terfenol-D particles and in Fig. 2 is an SEM for the Ni particles. In both cases, a distribution of spherical particles was produced, including nano-sized (sub-micron) particles.

The work on making the Ni particles into magnet-elastomer composites is described in the attached abstract. The work on producing the spherical particles by spark erosion is being prepared for submission to Journal of Materials Research.

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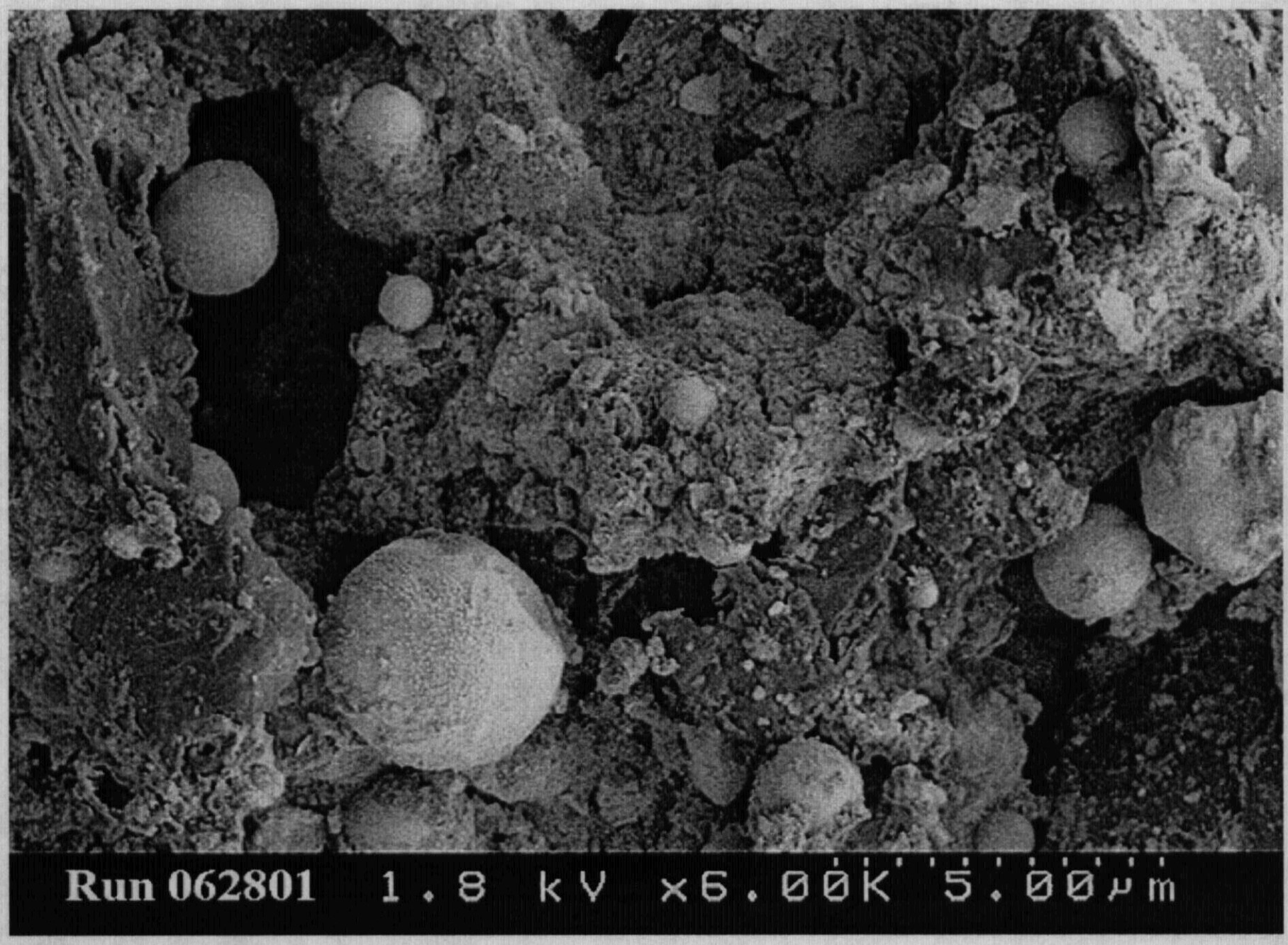

Figure 1. Terfenol-D particles produced by spark erosion.

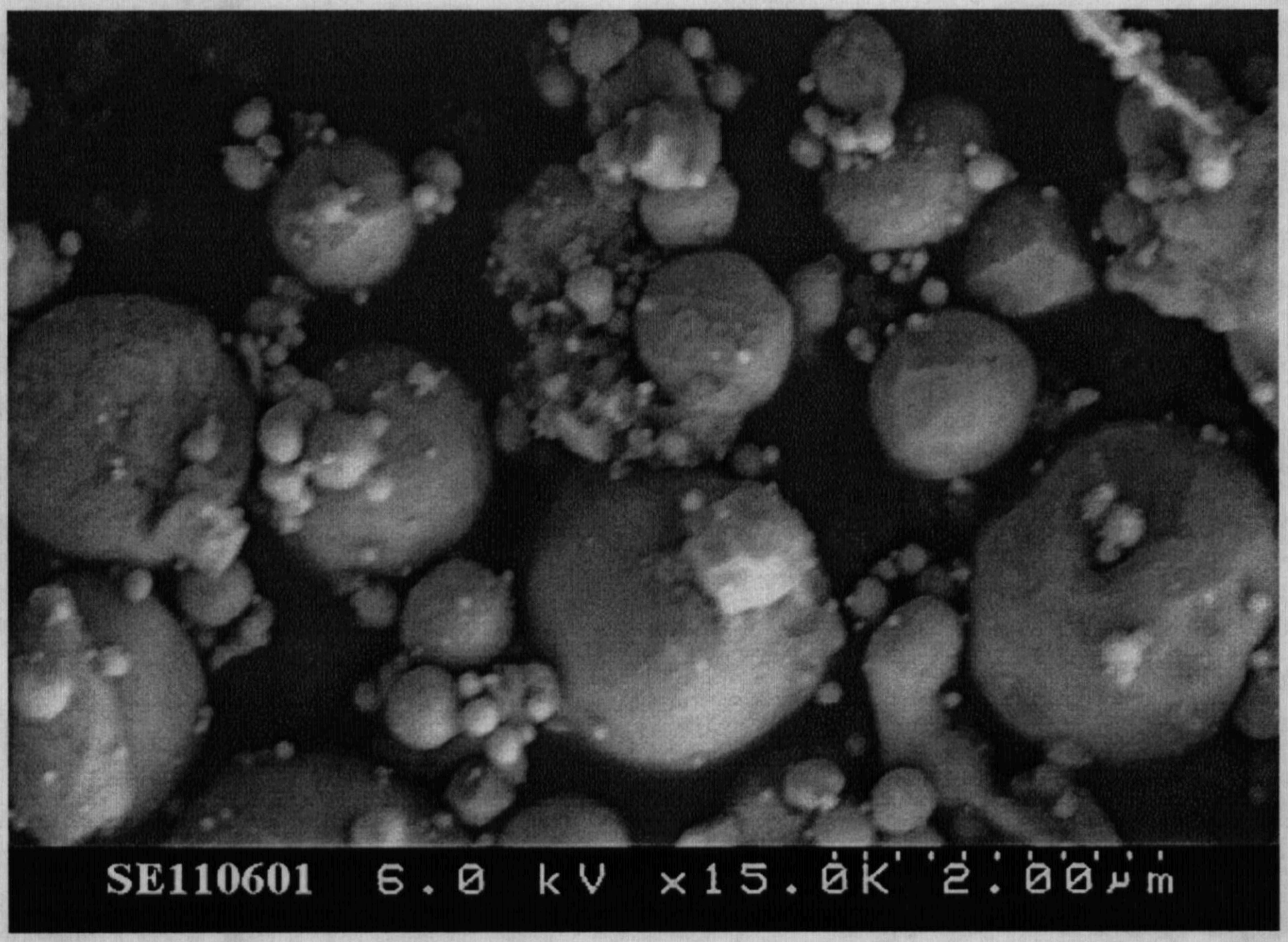

Figure 2. Nickel particles produced by spark erosion.